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ABSTRACT

Student achievement, cost, rural context, and qualitative differences relative to small/rural schools were analyzed in Alberta to address the choice between small elementary school construction and school consolidation with student busing. Studies in both the United States and Canada have found no consistent significant differences in student achievement between small and large schools. There is a major difference in cost and funding levels, however. Small school government grants do not offset this difference. Despite their greater cost, the number of small schools increased from 208 to 520 between 1974 and 1983. Busing for small schools costs less than for large schools which involve greater distances. A "bus or build" computer model for urban applications could be adapted to help school boards make cost effective small school/large consolidated school construction decisions. Given the quality and popularity of smaller schools in rural contexts, Alberta Education should research ways to reduce small school costs. Along with the narrative are descriptive charts and figures including an analysis of qualitative advantages and disadvantages of small schools. Following the narrative are four appendices with copies of graphs and tables from studies cited in the text and a bibliography. (PM)

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SMALL SCHOOL/LARGE SCHOOL COMPARATIVE ANALYSIS

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SMALL SCHOOL/LARGE SCHOOL COMPARATIVE ANALYSIS

October 9, 1984

Prepared by:

Planning & Research

School Buildings Services

Alberta Education

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EXECUTIVE SUMMARY

Research Focus

This study addresses the question, When given a choice, should small elementary schools be allowed to proliferate, or is school consolidation and student busing the recommended alternative?

Student achievement, costs, and the rural context as well as qualitative advantages and disadvantages relative to small schools were analyzed. The potential means of compensating for shortcomings of small schools were also addressed.

Achievement

Two of three studies of student achievement in Alberta which correlate school size with student achievement found no significant difference in student achievement as a function of school size. One study found that student achievement was higher in small schools.

Published student achievement findings in Canada and the United States indicate that in most cases there is no significant difference in student achievement between large and small schools, although in a few specific cases, student achievements have been higher in both small and large schools. Research suggests that factors other than school size are more important predictors of student achievement.

Cost and Funding Levels

Small schools adversely affect direct costs and the availability of instructional funding. Research indicates that economies of scale can be achieved in elementary schools for the size range of between 300-500 students in terms of instructional, administrative and overhead costs per student.

In 1981 small schools in Alberta had an average per pupil expenditure of $420, or 22 percent more than larger schools. Small schools cannot acquire as varied educational resources as large schools under funding schemes based on enrolment. In Alberta, government grants for small schools do not fully offset the additional expenditure levels. However, small schools often result in lower transportation costs due to shorter bus routes.

Decisions to affect school size based on cost are under local control. During the period from 1974 to 1983 the number of small schools increased from 16 percent of the total number of schools in Alberta to 34 percent. The recently developed Bus or Build computer model could be adapted to assist rural school jurisdictions make cost effective decisions regarding the relative size of schools.

Qualitative Advantages and Disadvantages

A number of intangible benefits and problems are associated with small schools. Factors include, teacher responsibilities, community interaction, and administration. The relative importance for most of these factors is not known for small elementary schools in Alberta. School size also affects program variety, but this effect is minimized at the elementary level, because each elementary teacher usually provides a complete program for students in their classroom.

The Rural Context

The literature indicates that accommodating the attributes of rural communities suggest policies that allow for the differences in rural schools from each other and their urban counterparts. An inference that can be drawn from recent literature is that the consolidation movement is being rethought in favour of increased support for small schools in the rural context.

Means to Overcome Shortcomings of Small Schools

Measures have been utilized in Canada and the United States to overcome the shortcomings of small schools. Some of these measures may be appropriate in Alberta. New applications of computer and communication technology could be developed to further enhance educational quality in small rural schools. New concepts of interschool cooperation could reduce administrative and educational costs.

Conclusion

The decision to allow small schools to proliferate is a choice between the qualitative benefits of small schools in the rural context and the economic rationalization of consolidation. In most cases there is no significant difference in student achievement between small and large schools.

Given the fact that a full one-third of the schools in Alberta are considered small schools under grants program descriptors, it may be appropriate for Alberta Education to research appropriate means to reduce the relatively higher costs associated with small schools, and their relative importance to the rural way of life.

Introduction

This study addresses the question, When given a choice, should small elementary schools be allowed to proliferate, or is school consolidation and student busing the recommended alternative?

Student achievement, costs, and the rural context as well as qualitative advantages and disadvantages relative to small schools were analyzed. Potential means of compensating for shortcomings of small schools were also addressed.

Much of the uniqueness of small schools is qualitative, and is not easily measured by the tools of educational research. The problem is the number of appropriate variables and the complexity of their interactions related to the measure of educational quality and opportunity. The size of a school affects its costs, funding levels, student organization, education program variety, extracurricular activities, staffing, available educational resources, and administration.

Achievement

Recent achievement test results are displayed in Figure I. No significant differences in student achievement were found to exist for a selected sample in the 1982-83 achievement testing program[1]. This differs from findings of the Alberta Assessment of School Mathematics (1979)[2] which indicated that... "in general, the small and medium (sized) schools outperformed the large school."

A 1984 Study of Private Schools in Alberta[3] indicated "that there is no consistent effect on student achievement attributable to school size. None of the statistical tests even approach significance at any grade level."

Published findings from other jurisdictions indicate that in most cases pupils in small schools do not seem to have poorer achievement than pupils in large schools, although in a few specific cases student achievements have been higher in both small and large schools.

Research suggests that factors other than school size seem to be more important in determining the degree of pupil achievement in schools. Socio-economic factors such as level of parent education and rural-urban residency appear to be more significant than school size.

A study in Montana[4] on the achievement of bus transported students in high schools did not find a correlation between student achievement and busing time up to 90 minutes one way. Comparable data for Alberta elementary schools does not currently exist.

1 Source: Student Evaluation Branch, Alberta Education (see Appendix I)

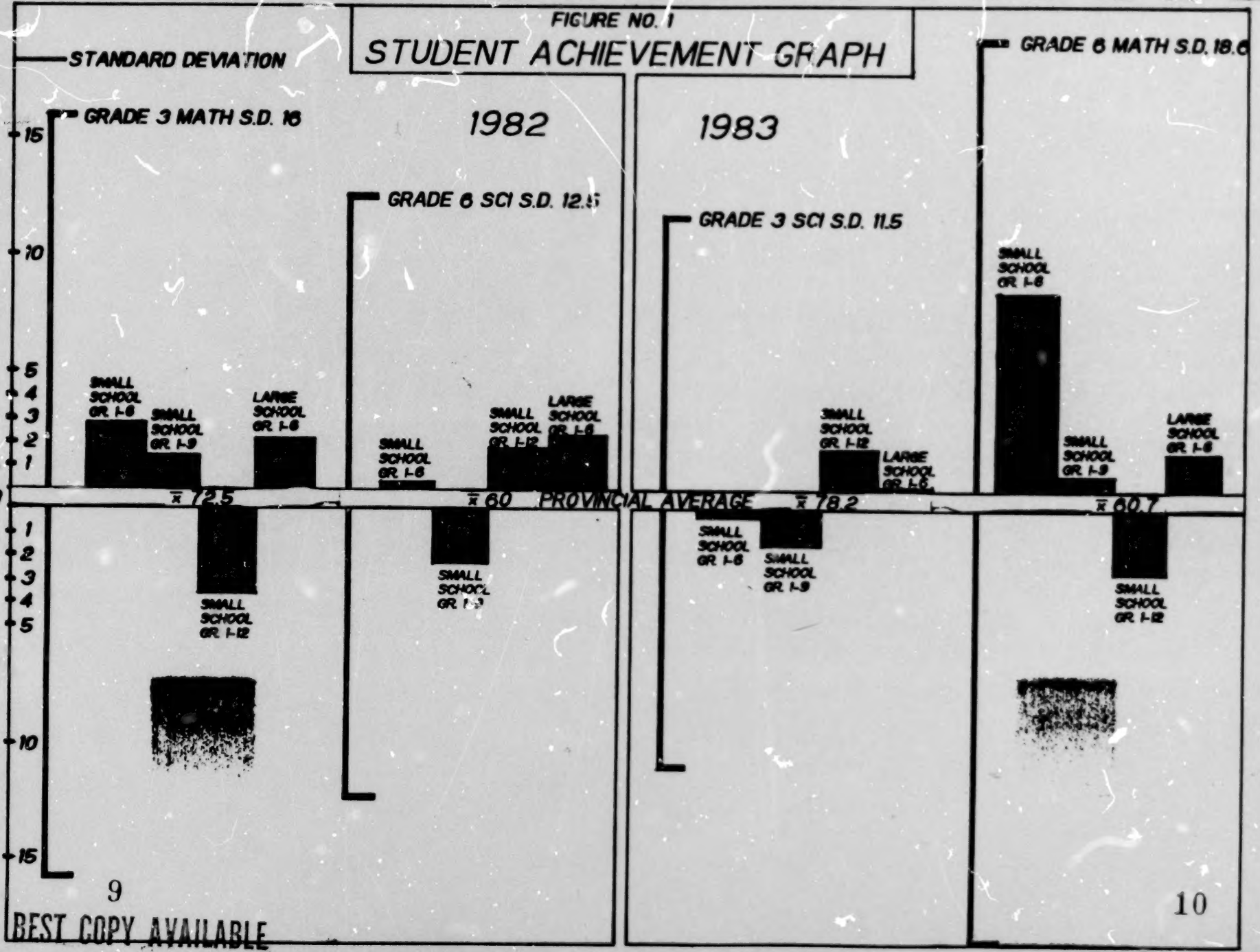
2 P. 85-87 Alberta Assessment of School Mathematics: Condensed Report Alberta Minister's Advisory Committee on Student Achievement, April, 1979 (See Appendix II)

3 "Private Schools Study" Draft Report, Woods Gordon 1984 (see Appendix II)

4 Thibeault, Robert J. et al "The Achievement of Bus Transported Students" Journal of Teaching and Learning, V2, n3, p. 17-22, January, 1977

FIGURE NO. 1

STUDENT ACHIEVEMENT GRAPH



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The literature generally agrees that small schools adversely affect costs and directly influence funding levels. Small schools allocate more funds per pupil than larger schools. Funds for books and materials that are supplied by a flat per pupil formula for all schools result in small schools being able to purchase fewer items and thus offer less variety of books, materials and equipment.

The general relationship between cost and elementary school size is noted in Figure II. Research indicates that economics of scale can be obtained in elementary schools up to 300-500 students. As school size decreases, per pupil costs gradually decrease until the school size reaches 300 - 500 students. At this point costs start to rise with decreasing size. The specific relationship of the cost per pupil to school size varies for individual schools depending on local factors.

In 1981 small schools in Alberta had an average per pupil expenditure of $420 or 22 percent more than non-small schools[1], and $638 or 38 percent more than the provincial average.[2] Significant higher funding allocation for small schools occurred in the categories of salaries, contracted services for maintenance and operation, and public utilities services. A breakdown of 1981 costs by expenditure category for small and non-small schools is noted in Table I.

In Alberta, government grants for small schools do not fully offset the additional expenditure levels. In 1981 the Small School Assistance Grant provided assistance of $22/pupil, or approximately five percent of the additional costs of operating small schools.

Decisions to affect school size based on cost are under local control. Despite the increased cost, the number of small schools increased from 208 in 1974 to 320 in 1983. This represents an increase of small schools from 16 percent of the provincial total number of schools in 1974 to 34 percent in 1983.

Busing

Associated with direct costs attributable to small/large schools are the costs of busing students. Smaller schools usually involve shorter bus routes than do consolidated larger schools, with results that transportation costs and student travel time are reduced.

Total per student costs can be minimized through increasing the size of a school until the increase in average transportation costs associated with adding one more student is just offset by the decrease in per student instructional, administrative and building costs associated with adding one more student.

Alberta Education has funded development of computer software to assist school boards to make cost effective decisions between busing and capital construction projects. The Bus or Build computer model now developed for urban applications could be adapted to assist school boards to make cost effective decisions regarding providing small schools vs large consolidated ones (see Appendix III).

1 Small Schools for the purpose of this analysis are those schools that are considered small schools under grant program descriptors.

2 Jefferson, Dr. Anne L. **Small School Assistance/Small Jurisdiction Grants Review** Planning and Research, Alberta Education, January, 1983

FIGURE NO. 2

PER PUPIL COSTS

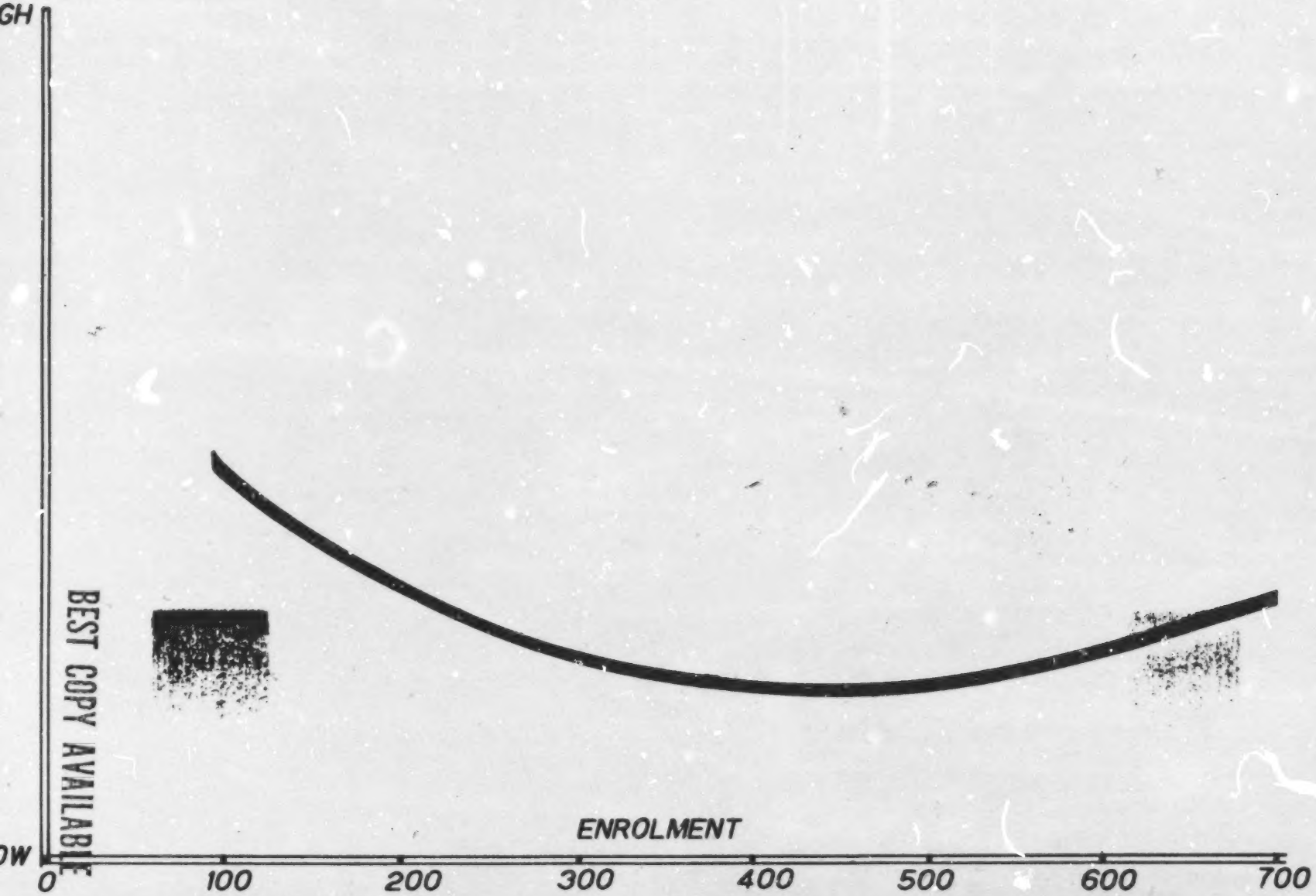

Table 1

COMPARISON OF THE 1981 OPERATIONAL PER PUPIL COSTS OF SMALL AND NON-SMALL SCHOOLS

Expenditure Category	Small Schools			Non-Small Schools		
	Elem.	Jr.	Elem.-Jr.-Sr.	Elem.	Jr.	Elem.-Jr.-Sr.
INSTRUCTIONAL & ADMINISTRATION						
Salaries						
Certificated Regular	$ 1,650	$ 1,349	$ 1,516	$ 1,184	$ 1,475	$ 1,294
Certificated Temporary	24	24	22	17	17	21
Uncertificated Regular	143	122	78	96	29	36
Uncertificated Temporary	23	4	5	---	---	---
Employee Benefits & Allowances						
Subsidized Housing & Board	---	---	---	---	---	---
Advanced Study & Bursaries	---	8	10	4	---	---
In-Service Training	3	9	4	4	1	---
Other	63	82	67	61	69	54
Services Purchased & Contracted						
Professional & Technical Services	10	9	10	7	8	5
Postage & Communications	4	5	5	2	---	7
Travel & Subsistence	7	20	7	4	2	3
Rentals	5	8	5	4	---	8
Tuition	---	---	---	4	---	---
Dues & Fees	3	4	5	1	---	---
Printing & Binding	1	1	1	---	---	---
Supplies & Materials						
Supplies	40	63	55	36	32	38
Textbooks	24	21	33	20	19	18
Media Materials	10	22	12	14	9	10
Warehouse Inventory Adjustment	---	---	---	---	---	---
Transfers						
Interfund	---	---	---	---	---	---
School Jurisdictions	2	---	11	---	---	---
Other Government Authorities	---	---	11	---	---	---
Organizations & Individuals	11	---	---	---	---	---
OPERATION & MAINTENANCE						
Salaries						
Uncertificated Regular	178	174	110	117	109	116
Uncertificated Temporary	49	8	46	1	---	---
Employee Benefits & Allowances						
Subsidized Housing & Board	---	---	---	---	---	---
In-Service Training	---	---	---	---	---	---
Other	10	12	8	6	11	9
Services Purchased & Contracted						
Professional & Technical Services	47	18	42	13	---	30
Public Utility Services	95	72	58	59	53	29
Travel and Subsistence	8	2	1	1	3	---
Maintenance & Repair Service	28	31	33	69	22	---
Rentals	1	2	1	---	---	---
Taxes	4	3	3	3	3	3
Insurance & Bond Premiums	17	13	15	12	---	7
Supplies & Materials						
Supplies	38	23	26	17	37	26
TOTAL	$ 2,298	$ 2,309	$ 2,312	$ 1,878	$ 1,899	$ 1,714

Source: Jeffersen, Dr. Anne L., Small School Assistance/Small Jurisdiction Grants Review, Planning and Research, Alberta Education, January, 1983.

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Busing distances are governed by a reasonable length of time spent on buses by pupils. For elementary pupils in a rural context the generally accepted guideline is between 1 hour and 1.5 hours per day as a maximum desirable time. (Note: The Hill Spring pupils bused to Glenhill spend between 40 minutes and 1 hour and 40 minutes on the bus each day.)

Qualitative Advantages and Disadvantages

The qualitative or intangible benefits and problems associated with small schools noted in the literature are summarized in Figure III. The relative significance of these factors for schools in Alberta is not known, except for the adequacy of school counselling and guidance programs and services. The Task on School Counselling and Guidance report indicated that . . . "size is not a factor in adequacy ratings assigned to elementary and junior high schools"[1].

The impact of small school size on educational program variety is minimized at the elementary level compared to junior and senior high schools, because each elementary teacher usually provides a complete program for students in the classroom.

Isolation, sparsity, smallness and differentness impede but do not prohibit pursuit of quality education for rural and small schools.

Teachers in rural small schools face some of the most complex responsibilities found in education. They teach a variety of subjects to diverse student populations and must often deal in the same classroom with the complex educational, social and personal problems of handicapped, gifted, and economically disadvantaged students.[2]

1 Planning and Research, School Counselling and Guidance in Alberta, Alberta Education, 1981.

2 Nimnicht, Glendon P., & Partridge, Arthur R., Small Schools Can be Good Schools Ford Foundation, New York, N.Y., 1962

FIGURE III

SMALL SCHOOL
QUALITATIVE ANALYSIS

ADVANTAGES

Greater opportunities for local autonomy.

Closer relations and cooperation among teachers, parents, students and community.

Less formalized interactions among students, staff and parents.

More opportunities per student to participate in a wider variety of settings, in academic and extracurricular activities, and assume more responsibility and important positions

Slower paced, less pressured environment.

Decreased student travel time.

Provide security needed by younger children.

Close student/teacher relationships.

Teachers are more often knowledgeable about the special needs, talents and problems of students.

Subject matter may be more effectively integrated into the various life functions.

Small school teachers are more likely to utilize innovative and individual teaching methods as well as open classroom situations with working groups that cut across grade levels.

The small school is more likely to develop staff that reaches out to take on administrative responsibilities and has a voice in running the school.

Greater opportunity for interaction, communication and individual attention.

The principal may know staff well and can make maximum use of individual talents.

A teacher may know students on more grade levels than would be the case in a larger school, thereby contributing to overall social development.

DISADVANTAGES

Problems of Instruction/Pupil Organization

Each class contains a total range of achievement, and opportunities to reduce the range of differences in a class are not present.

If students are retained they are more likely to spend the second year in the same grade with the same teacher.

There is no opportunity to match student needs with teacher strengths.

Students come in contact with fewer teachers in schools with split grades.

Problems of Instruction/Teaching Staff

Team teaching opportunities are reduced.

Each teacher works as the only teacher of a grade level reducing opportunities for cooperative planning and problem solving.

Inservice activities are difficult to plan for the school as a unit.

Many teachers do not like assignments in small schools, preferring the stimulation of daily contact with other professionals.

Teachers are asked to assume more responsibilities as a respresentative of the school and as sponsor of extra-curricular activities.

A small professional staff has fewer diverse approaches.

Problems in Providing Services

a. Clerical. The basis for providing secretarial help to teachers is not sufficient for continuous service.

b. Itinerant services. Art, music, speech therapy, reading, school-based physical education, and school nurse are very difficult to schedule on "like time" basis to a small school.

c. Library is not staffed full time.

Administrative Problems

a. It is difficult to hold principals.

b. The principal, if assigned to two schools, is not always at the school in which he is needed.

c. Cafeteria operation presents difficulties of small-unit operation.

Problems to School System

Recognizing the problems listed above, more time, attention, and services on a per student basis may be concentrated on the small school than on large schools.

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Sources: Stemnock, Suzanne K. Summary of Research on Size of Schools and School District, Educational Research Services, Inc. Arlington, Virginia, 1974.

Day, C. William "Are Small Schools Better?" School Business Affairs, V45 N7 P. 32-33, July, 1979.

The Rural Context

Rural conditions of isolation and sparsity necessitate creation of small schools when travel distances are too great and consolidation impractical. Some small rural schools exist as the only practical alternative. Variations in local needs and expectations of rural students and communities necessitate differences among rural schools.

Research indicates that pursuit of quality education for rural and small schools must take into account the following attributes:

- Rural communities and schools are different from urban communities and schools;
- Rural communities differ from each other and interventions to improve rural education must recognize these differences;
- Rural schools and rural communities operate as a single integrated social structure; and
- Doing things to or for rural communities is inconsistent with rural tradition[1].

Responding to these attributes "means creating public policy that values and accommodates rural cultures and rural schools rather than trying to reshape these institutions into a likeness of larger schools and communities". . . and "means a differentiated policy, that allows and assists rural schools and rural communities to build on their strengths and overcome their weaknesses"[2].

Means to Overcome Shortcomings in Small Schools

Research indicates that it is possible to overcome weaknesses and achieve a high degree of quality educational opportunities in small schools.

The following five basic conditions have been identified as vital to achieving quality education in rural and small schools:

- An attactive, comfortable and pleasant building with a school climate conducive to learning;
- Strong leadership from teaching and administrative personnel;
- A core curriculum which reflects the culture and values of rural communities;
- High academic expectations for all, not just some, students; and
- The use of standarized tests to measure progress and make plans for improvement[1].

Specific methods employed in other jurisdictions to overcome the shortcomings of small schools include, . . . "Multiple-class teaching, flexible scheduling, shared services and personnel, honors programs, team teaching, tape-recorded class lectures and reports, correspondence courses, college students and local citizens as teachers, peer teaching, work-practice programs, home projects, and use of community facilities"[2]. The use of computer and communication technology could provide a means to enhance education in small rural schools.

[1] Tillman, Jerome "In Pursuit of Quality: The Agenda For Rural and Small Schools" Rural Educator, V5 NL P. 32-23, Fall, 1983.

[2] Nachtigal, Paul M., Improving Rural Schools, National Institute of Education, 1980.

Conclusions

The decision to allow small schools to proliferate is a choice between the qualitative benefits of small schools in the rural context and the economic rationalization of consolidation. In most cases there is no significant difference in student achievement between small and large schools.

Given the fact that a full one-third of the schools in Alberta are considered small schools under grants program descriptors, it may be appropriate for Alberta Education to research appropriate means to reduce the relatively higher costs associated with small schools, and their relative importance to the rural way of life.

Appendix I

Tested Schools by Enrolment
Results 1982-84 Achievement Testing Program
Achievement Test Summary
Achievement Test Result Comparative
Analysis

TESTED SCHOOLS BY ENROLMENT

Schools Offering Grades 1-6
(under fifty students)

No.	School Name	Jurisdiction	Enrolments
2723	Spedden	County of Smoky Lake No. 13	13
2017	Bryan	Yellowhead Division No. 12	18
6906	Etzikom	County of Forty Mile No. 8	19
4135	Nordegg	Rocky Mountain Division No. 15	20
2707	Rich Lake	Lac La Biche Division No. 51	25
2308	Littleport	County of Barrhead No. 11	29
5403	Carmangay	County of Vulcan No. 2	30
1613	McLennan	High Prairie Division No. 48	34
[illegible]3	River Course	County of Vermilion River No. 24	36
6706	Haddington	County of Newell No. 4	39
1502	Brownvale	Peace River Division No. 10	38
1609	Jean Cote	High Prairie Division No. 48	43
1110	Valhalla	County of Grande Prairie No. 1	45
4401	Benalta	County of Red Deer No. 23	45
5111	Midway	County of Mountain View No. 17	49

Schools Offering Grades 1-9
(under seventy students)

No.	School Name	Jurisdiction	Enrolments
1814	Panny Camp	Northland Division No. 61	18
1839	Zama City	Ft. Vermilion Division No. 52	30
2805	Lafond	County of St. Paul No. 19	34
6804	Jenner	Medicine Hat Division No. 4	35
4804	Harts	Neutral Hills Division No. 16	35
5801	Homestead Coulee	Berry Creek Division No. 1	40
6801	Bindloss	Medicine Hat Division No. 4	40
6807	Schuler	Medicine Hat Division No. 4	47
4904	Czar	Provost Division No. 33	48
6206	Del Bonita	Cardston Division No. 2	50
2721	Bellis	County of Smoky Lake No. 13	53
4825	Halkirk	County of Paintearth No. 18	54
6510	Wrentham	County of Warner No. 5	58
3606	Minburn	County of Minburn No. 27	60
4212	Sylvan Heights	County of Ponoka No. 3	69

Schools Offering Grades 1-12
(under 150 students)

No.	School Name	Jurisdiction	Enrolments
6908	Manyberries	County of Forty Mile No. 8	98
5802	New Cessford	Berry Creek Division No. 1	100
4801	Altario	Neutral Hills Division No. 16	107
1308	Wanham	Spirit River Division No. 47	110
3803	Dewberry	County of Vermilion River No. 24	113
5903	Cereal	Acadia Division No. 8	116
5827	Youngstown	Rangeland Division No. 9	117
1705	Rainbow Lake	Ft. Vermilion Division No. 52	122
5504	Hussar	County of Wheatland No. 16	136
6602	Chamberlain	Taber Division No. 6	140
4512	Round Hill	County of Camrose No. 22	144

Schools Offering Grades 1-6
(over 300 students)

No.	School Name	Jurisdiction	Enrolments
7137	Kensington	Edmonton Public No. 7	323
7178	Greenfield	Edmonton Public No. 7	455
7196	Rundle	Edmonton Public No. 7	333
7243	Sweet Grass	Edmonton Public No. 7	337
9216	Greenview	Calgary School District No. 19	333
9223	Mayland Heights	Calgary School District No. 19	385
9238	Varsity Acres	Calgary School District No. 19	358
9256	Silver Springs	Calgary School District No. 19	457
4448	Oriole Park	Red Deer School District No. 104	307
4452	West Park	Red Deer School District No. 104	339
4447	Aspen Heights	Red Deer School District No. 104	243
6447	Park Meadows	Lethbridge School District No. 51	455
6450	Senator Buchanan	Lethbridge School District No. 51	300
6445	Nicholas Sheran	Lethbridge School District No. 51	430
6845	Crestwood	Medicine Hat School District No. 76	338
6847	Ross Glen	Medicine Hat School District No. 76	397
6856	Vincent Massey	Medicine Hat School District No. 76	367

Achievement Summary

		1982		1983	
		3 Math	6 Sci.	3 Sci.	6 Math
Small 1-6	n	15	8	7	11
	x	70.1	60.3	77.6	67.8
	S.D.	11.9	9.1	6.7	11.3
Small 1-9	n	1.5	8	8	8
	x	71.7	57.6	76.3	60.6
	S.D.	11.4	8.7	8.3	8.2
Small 1-12	n	11.0	8	8	5
	x	69.4	61.9	79.9	57.2
	S.D.	7.8	3.7	6.3	9.1
Large 1-6	n	17	15	15	12
	x	75.1	62.3	78.1	61.7
	S.D.	6.8	4.0	4.4	6.6
Prov. Average	x	73	60	78	60
	S.D.	16	12.5	11.5	18.6

Achievement Test Results

Comparative Analysis

1982 Grade 3 Math	N	N_2	S_1	S_2	$\bar{x}_1$	$\bar{x}_2$	t	df	Findings
Small 1-6/Small 1-9	15	15	11.9	11.4	70.1	71.7	-3.63	28	NSD
Small 1-6/Small 1-12	15	11	11.9	7.8	70.1	69.4	.163	24	NSD
Small 1-6/Large 1-6	15	17	11.9	6.8	70.1	75.1	-1.433	30	NSD
1982 Grade 6 Science									
Small 1-6/Small 1-9	8	8	9.1	8.7	60.3	57.6	.567	14	NSD
Small 1-6/Small 1-12	8	8	9.1	3.7	60.3	61.9	.431	14	NSD
Small 1-6/Large 1-6	8	15	9.1	4.0	60.3	62.3	-.697	21	NSD
1983 Grade 3 Science									
Small 1-6/Small 1-9	7	8	6.7	8.3	77.6	76.3	.308	13	NSD
Small 1-6/Small 1-12	7	5	6.7	6.3	77.6	79.9	-.549	10	NSD
Small 1-6/Large 1-6	7	12	6.8	4.4	77.6	78.0	.185	17	NSD
1983 Grade 6 Math									
Small 1-6/Small 1-9	11	8	11.3	8.2	67.8	60.6	1.45	17	NSD
Small 1-6/Small 1-12	11	5	11.3	9.1	67.8	57.2	1.724	14	NSD
Small 1-6/Large 1-6	11	12	11.3	6.6	67.8	61.7	1.525	21	NSD
1982 Grade 3 Math									
Small 1-9/Small 1-12	15	11.0	11.4	7.8	71.7	69.4	.555	24	NSD
Small 1-9/Large 1-6	15	17	11.4	6.8	71.7	75.1	-1.01	30	NSD
1982 Grade 6 Science									
Small 1-9/Small 1-12	8	8	8.7	3.7	57.6	61.9	-1.20	14	NSD
Small 1-9/Large 1-6	8	15	8.7	4.0	57.6	62.3	-1.69	21	NSD
1983 Grade 3 Science									
Small 1-9/Small 1-12	8	8	8.3	6.3	76.3	79.9	-.914	14	NSD
Small 1-9/Large 1-6	8	15	8.3	4.4	76.3	78.1	-.649	21	NSD
1983 Grade 6 Math									
Small 1-9/Small 1-12	8	5	8.2	9.1	60.6	57.2	.641	11	NSD
Small 1-9/Large 1-6	8	12	8.2	6.6	60.6	61.7	-.314	18	NSD
1982 Grade 3 Math									
Small 1-12/Large 1-6	11.0	1.7	7.8	6.8	69.4	75.1	-1.969	26	NSD
1982 Grade 6 Science									
Small 1-12/Large 1-6	8	15	3.7	4.0	61.9	62.3	-.2239	21	NSD
1983 Grade 3 Science									
Small 1-12/Large 1-6	8	15	6.3	4.4	79.9	78.1	.764	21	NSD
1983 Grade 6 Science									
Small 1-12/Large 1-6	5	12	9.1	6.6	57.2	61.7	-1.069	15	NSD

Table I

Achievement Program Comparative Analysis
1982 Grade 3 Math

	Small School Grd. 1-6 Ave. Score 70.1 S.D. 11.9 N 15	Small School Grd. 1-9 Ave. Score 71.7 S.D. 11.4 N 15	Small School Grd. 1-12 Ave. Score 69.4 S.D. 7.8 N 11.0	Large School Grd. 1-6 Ave. Score 75.1 S.D. 6.8 N 17
Small School Grd. 1-6 Ave. Score 70.1 S.D. 11.9 N 15		-1.6 NSD	+0.7 NSD	-5.0 NSD
Small School Grd. 1-9 Ave. Score 71.7 S.D. 11.4 N 15	+1.6 NSD		2.3	
Small School Grd. 1-12 Ave. Score 69.4 S.D. 7.8 N 11.0	-0.7 NSD	-2.3		
Large School Grd. 1-6 Ave. Score 75.1 S.D. 6.8 N 17	5.0 NSD			

Table II

Achievement Program Comparative Analysis
1982 Grade 6 Science

	Small School Grd. 1-6 Ave. Score 60.3 S.D. 9.1 N 8	Small School Grd. 1-9 Ave. Score 57.6 S.D. 8.7 N 8	Small School Grd. 1-12 Ave. Score 61.9 S.D. 3.7 N 8	Large School Grd. 1-6 Ave. Score 62.3 S.D. 4 N 15
Small School Grd. 1-6 Ave. Score 60.3 S.D. 9.1 N 8		2.7 NSD	-1.5 NSD	-2.0 NSD
Small School Grd. 1-9 Ave. Score 57.6 S.D. 8.7 N 8	-2.7 NSD		-4.3	
Small School Grd. 1-12 Ave. Score 61.9 S.D. 3.7 N 8	1.6 NSD	4.3		
Large School Grd. 1-6 Ave. Score 62.3 S.D. 4 N 15	2.0 NSD			

Table III

Achievement Program Comparative Analysis
1983 Grade III Science

	Small School Grd. 1-6 Ave. Score 77.6 S.D. 6.7 N 7	Small School Grd. 1-9 Ave. Score 76.3 S.D. 8.3 N 8	Small School Grd. 1-12 Ave. Score 79.9 S.D. 6.3 N 8	Large School Grd. 1-6 Ave. Score 78.1 S.D. 4.4 N 15
Small School Grd. 1-6 Ave. Score 77.6 S.D. 6.7 N 7		1.3 NSD	-2.3 NSD	-0.5 NSD
Small School Grd. 1-9 Ave. Score 76.3 S.D. 8.3 N 8	-1.3 NSD		-3.6	
Small School Grd. 1-12 Ave. Score 79.9 S.D. 6.3 N 8	2.3 NSD	3.6		
Large School Grd. 1-6 Ave. Score 78.1 S.D. 4.4 N 15	0.5 NSD			

Table IV

Achievement Program Comparative Analysis
1983 Grade 6 Math

	Small School Grd. 1-6 Ave. Score 67.8 S.D. 11.3 N 11	Small School Grd. 1-9 Ave. Score 60.6 S.D. 8.2 N 8	Small School Grd. 1-12 Ave. Score 57.2 S.D. 9.1 N 5	Large School Grd. 1-6 Ave. Score 61.7 S.D. 6.6 N 12
Small School Grd. 1-6 Ave. Score 67.8 S.D. 11.3 N 11		7.2 NSD	10.6 NSD*	6.1 NSD
Small School Grd. 1-9 Ave. Score 60.6 S.D. 8.2 N 8	-7.2 NSD		3.4	
Small School Grd. 1-12 Ave. Score 57.2 S.D. 9.1 N 5	-10.6 NSD*	-3.4		
Large School Grd. 1-6 Ave. Score 61.7 S.D. 6.6 N 12	-6.1 NSD			

* Approaches significance

Appendix II

Alberta Assessment of
School Mathematics
Condensed Report

Section VIII.2 School Size
P. 85-87

Private Schools Study, Draft Report
Woods Gordon

Alberta Assessment of School Mathematics

CONDENSED REPORT

APRIL, 1979

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Alberta

Minister's Advisory Committee
on Student Achievement

VIII.2 School Size

In order to utilize the variable of school size, the sample of schools at a given grade level was classified as small (s), medium (m), or large (l). The division points for the categories differed with each grade level. Table VIII-3 gives the summary figures on the classification of schools at each grade level.

Table VIII-3

Distribution of Respondents According to School Size

Grade	School Size		
	Small	Medium	Large
3	(1-30) 906	(31-70) 1483	(71-?) 984
6	(1-30) 900	(31-70) 1083	(71-?) 1085
9	(1-40) 576	(41-101) 835	(102-?) 1783
12	(1-65) 824	(66-195) 900	(196-?) 1720

As with the variable of sex, the variable of school size had a decided effect on the survey results. In general, the small and medium schools outperformed the large schools. In order to get at the size variable average performance was calculated for each school size for each of the content areas for each Division. Thus, an average performance figure was obtained for small schools on number at Division I, for small schools on number at Division II, and so on up through large schools on Consumer Items at Division IV. These averages were compared for each content area at each Division and the best and worst performance could be identified. For Division I, the "best performer" was the small school and the large school was the worst. Over the 120 items as a whole, the difference between these two school types is significant at the 0.01 level. For Division II, the medium school is the best, the large school the worst, and again the difference is significant at the 0.01 level. For Division III, the medium school is still the best performer but this time the small school is the worst. This difference is as well significant at the 0.01 level. For Division IV, the variable of school size was not significant. In order to get a better picture of these differences, Tables VIII-4 and VIII-5 were drawn up. These tables focus on the best and the worst performers respectively.

le VIII-4 shows the best performers for each content area at each Division. Certain cells in the le were left empty if no one school size did better than the nearest rival size by 1% or more. striking thing about Table VIII-4 is the complete absence of the large school. At Division I, small school predominates; at Division II and III the medium school predominates; at Division the variable of school size seems less relevant.

Table VIII-4

ool Size Differences as Related to the "Best Performance" over each Content Area at Each Division

Content	Division			
	I	II	III	IV
Number	s	m	mm	
Algebra	ss		mmmm	
Geometry	ss		mmm	s
Measurement			mm	
Statistics	ss	mm	m	
Consumer	--	--	--	

s (small)

m (medium)

l (large)

Each symbol in the table represents a 1% difference over the performance of the nearest rival size school.

concerns the "Worst Performance", Table VIII-5 gives the results. Striking here is the frequent urrence of the large school coupled with the complete absence of the medium school. It seems that large elementary school (enrolment of more than 70) is not the best as far as mathematics achieve- t is concerned. As well, the small junior high school is the least favorable. At the high school el, size appears not to make much difference. It should be realized that the above conclusions on the basis of averages. There were some schools that were contrary to the above trends.

Table VIII-5

ool Size Differences as Related to the "Worst Performance" for each Content Area at each Division

Content	Division			
	I	II	III	IV
Number		lll	ss	
Algebra		lll		
Geometry	l:	ll	l	
Measurement	llll		ss	
Statistics	lll	l	s	
Consumer	---	---	---	l

s (small)

m (medium)

l (large)

Each symbol represents a 1% difference under the performance of the next worse rival size school.

ANALYSIS OF ACADEMIC TEST RESULTS BY SCHOOL SIZE

One of the original variables to be investigated was the effect of school size on achievement. In very small schools, there may be only one child per grade, limiting teaching options considerably. In larger schools, there are more opportunities for social interaction, but class size may also be larger.

For purposes of this analysis, schools were divided into three groups by total enrollment. As in the original selection of sample schools, 'large' schools were defined as those with more than 100 students. Small schools were then further sub-divided into 'small' (40 to 100 students) and 'very small' (fewer than 40 students). Results of the analysis of reading and math tests by school size are presented in the tables, following.

ANALYSIS OF READING ACHIEVEMENT TEST RESULTS BY SCHOOL SIZE[1]

Reading Skill	School Size (Mean and Standard Deviation)			Sig. of Stat. Tests
	Large (>100)	Small (40-100)	Very Small (<40)	
Grade 3:				
Word Level Analysis	84.6 (5.5)	81.2 (9.6)	77.0 (12.3)	NS
Connected Discourse Explicit	74.0 (6.7)	69.6 (11.8)	66.5 (10.1)	NS
Connected Discourse Inferrential	78.2 (9.4)	76.8 (14.7)	70.8 (9.1)	NS
No. of Schools	12	11	6	MANOVA NS
Grade 6:				
Word Level Analysis	74.5 (7.2)	74.6 (5.5)	75.8 (6.9)	NS
Connected Discourse Explicit	74.8 (8.0)	73.5 (10.0)	72.1 (13.0)	NS
Connected Discourse Inferrential	66.7 (7.0)	66.7 (8.8)	64.9 (11.3)	NS
No. of Schools	12	12	7	MANOVA NS
Grade 9:				
Word Level Analysis	80.4 (7.0)	85.7 (4.6)	77.0 (3.1)	NS
Connected Discourse Explicit	69.8 (6.7)	68.5 (11.9)	73.3 (7.3)	NS
Connected Discourse Inferrential	71.5 (4.7)	73.4 (7.8)	72.6 (7.4)	NS
No. of Schools	10	8	3	MANOVA NS

1. Excludes schools with fewer than 3 students per grade.

ANALYSIS OF MATH ACHIEVEMENT TEST MEANS BY SCHOOL SIZE[1]

Math Skill	School Size (Mean and Standard Deviation)			Sig. of Stat. Tests
	Large (>100)	Small (40-100)	Very Small (<40)	
Grade 3:				
Achievement Test	74.3 (9.6)	65.6 (13.8)	68.8 (11.5)	NS
Addition	91.3 (4.1)	83.1 (9.3)	85.0 (10.6)	NS
Subtraction	87.5 (5.5)	77.6 (13.7)	85.0 (8.9)	NS
Multiplication	91.2 (7.5)	76.9 (25.0)	79.2 (26.1)	NS
Division	75.4 (12.8)	56.6 (33.6)	63.4 (31.0)	NS MANOVA
No. of Schools	12	11	5	NS
Grade 6:				
Achievement Test	60.3 (7.7)	55.3 (10.8)	58.1 (15.2)	NS
Addition	73.4 (8.5)	73.6 (10.8)	69.8 (15.3)	NS
Subtraction	71.2 (8.6)	71.7 (11.4)	73.7 (9.7)	NS
Multiplication	86.3 (6.7)	87.4 (7.2)	81.3 (12.2)	NS
Division	80.2 (9.8)	82.2 (9.0)	79.5 (13.4)	NS
Mixed Operations	83.1 (8.2)	87.4 (7.3)	83.4 (12.3)	NS
No. of Schools	12	12	5	MANOVA NS

1. Excludes schools with fewer than 3 students/grade.

RESULTS

1. These results indicate that there is no consistent effect on student achievement attributable to school size. None of the statistical tests even approach significance at any grade level.

Appendix III

Bus or Build Model

The Edmonton and Calgary Public Boards of Education have worked in conjunction with a consultant and Alberta Education to develop the Bus or Build Model. This computer model determines the additional debenture payments over a twenty year period, that will have to be paid by the Provincial Government and the Local Board, if a local school (or additional relocatables) is built in lieu of transporting students.

The debenture payments associated with all capital expenditures, including the construction of the local school, are calculated over a period of twenty years and compare these costs to those of busing students.

A. The model takes into account the following factors:

1. Current Interest Rate;
2. Additional Administration costs;
3. Maintenance and Utility Costs;
4. The number of pupil space exemptions;
5. Adjustment factor for equity in the provincial contribution;
6. The support factor and approved area factor for all construction as detailed in the "Proposed 1984-1988 Capital Plan", Finance and Administration Division, Alberta Education; and
7. The year at which the school and/or relocatables are no longer needed and the residual cost of these buildings.

B. The model projects the following factors:

1. The Board of Education's total enrolment for the next twenty years;
2. The number of pupil spaces leased or sold over the next twenty years
3. The future capital expenditure program; and
4. The potential enrolment within 2.4 km of the local school.

C. The model will analyze two cases:

1. The financial implications of no new school;
2. The financial implications if a new school is built;
3. The differences between these cases by year for 10 years;
4. Report the input data for each case;
5. Report capital proposal details, debenture payments, busing costs, operating costs, and student km and student hours spent on buses; and
6. Report similar data as differences between the two cases.

D. The model has the following benefits:

1. Help in the analysis of the economic implications for particular cases where new schools are proposed;
2. Help in determining the priority of a capital project (2nd or 7th priority);
3. Useful in determining policy concerning the tradeoff of capital and transportation support;
4. Determining rules of thumb for the benefits of busing or building new schools;
5. Demonstration to school boards of the financial issues involved in bus or build decisions;

6. Help in the complicated calculations of the support for capital programs and in determining the transportation; and
7. Data for the school board
   - total capital plan and details as in the Capital Budgeting System
   - details of the cost of the proposed school
   - school operating costs
   - transportation (full) costs
     - transit - board payment to city transit (if any)
       - student payments to school board
     - yellow - full cost - $ per pupil km
     - per student government grant for transportation over the specified minimum distance
   - bus speeds - transit, yellow
     - in local area, in non-local area
   - student population within and outside 2.4 km of proposed school - by year
   - geographical distribution of students who require busing
     - % on transit, on yellow
     - inside and outside 2.4 km of the proposed school, and to distant school
   - travel distances
     - by transit, by yellow
     - inside and outside 2.4 km to proposed school, and to distant school.

The Bus or Build Model provides valuable insights into the planning required when two government grant systems interact. The results from the analysis of various cases provides valuable knowledge concerning the directions the school boards will be moving because of government grants. In particular, the impact of the capital grants can be analysed. We believe that this tool will increase the ability of the School Buildings Services Branch to plan and demonstrate its competence to school boards.

Appendix IV

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